

# New Hampshire Volunteer Lake Assessment Program

## 2002 Bi-Annual Report for Darrah Pond Litchfield



NHDES  
Water Division  
Watershed Management Bureau  
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# OBSERVATIONS & RECOMMENDATIONS

Welcome to the New Hampshire Volunteer Lake Assessment Program! As your association continues to participate in VLAP over the years, the database created for your lake/pond will help your association track water quality trends and will ultimately enable the association and DES to identify potential sources of pollutants from the watershed that may affect water quality.

As a rule of thumb, *please* try to sample at least once per month during the summer months (June, July, and August). In addition, it may be necessary to conduct stormwater sampling at multiple locations along a stream using the bracketing technique to pinpoint sources of pollution, and baseline studies could involve bi-weekly or monthly sampling for an extended period of time. DES will let you know if this type of sampling is appropriate.

We understand that future sampling will depend upon volunteer availability, and the associations' water monitoring goals and funding availability. We would like to point out that **water quality trend analysis is not feasible with only a few data points**. It will take many years to develop a statistically sound set of water quality baseline data. Specifically, after 10 consecutive years of participation in the program, we will be able to analyze the in-lake data with a simple statistical test to determine if there has been a significant change in the annual mean chlorophyll-a concentration, Secchi-disk transparency reading, and phosphorus concentration. Therefore, frequent and consistent sampling will ensure useful data for future analyses.

Please contact the VLAP Coordinator early this spring to schedule our annual lake visit. **It would be to your advantage to have our visit early in the summer to refresh your sampling skills!**

**Finally, please remember that one of your most important responsibilities as a volunteer monitor is to educate your association, community, and town officials to let them know the quality of your lake/pond and what can be done to protect it!**

After reviewing data collected from **DARRAH POND**, the program coordinators recommend the following actions.

#### **FIGURE INTERPRETATION**

- **Figure 1 and Table 1:** The graphs in Figure 1 (Appendix A) show the historical and current year chlorophyll-a concentration in the water column. Table 1 (Appendix B) lists the maximum, minimum, and mean concentration for each sampling season that the lake/pond has been monitored through the program.

Chlorophyll-a, a pigment naturally found in plants, is an indicator of the algal abundance. Because algae are usually microscopic plants that contain chlorophyll-a, and are naturally found in lake ecosystems, the chlorophyll-a concentration found in the water gives an estimation of the concentration of algae or lake productivity. The mean (average) summer chlorophyll-a concentration for New Hampshire's lakes and ponds is 7.02 ug/L.

Similar to the summer of 2001, the summer of 2002 was filled with many warm and sunny days and there was a lower than normal amount of rainfall during the latter-half of the summer. The combination of these factors resulted in relatively warm surface waters throughout the state. The lack of fresh water to the lakes/ponds reduced the rate of flushing which may have resulted in water stagnation. Due to these conditions, many lakes and ponds experienced increased algae growth, including filamentous green algae (the billowy clouds of green algae typically seen floating near shore), and some lakes/ponds experienced nuisance cyanobacteria (blue-green algae) blooms.

The current year data (the top graph) show that the chlorophyll-a concentration **increased greatly** from June to August. The chlorophyll-a concentration in June was ***much less than*** the state mean, and in August was ***approximately equal to*** the state mean.

The historical data (the bottom graph) show that the 2002 chlorophyll-a mean is ***less than*** the state mean.

After 10 consecutive years of sample collection, we will be able to conduct a statistical analysis of the historic data to objectively determine if there has been a significant change in the annual mean chlorophyll-a concentration since monitoring began.

While algae is naturally present in all lakes/ponds, an excessive or increasing amount of any type is not welcomed. In freshwater lakes/ponds, phosphorus is the nutrient that algae depend upon for growth. Therefore, algal concentrations may increase when there is

an increase in nonpoint sources of nutrient loading from the watershed, or in-lake sources of phosphorus loading (such as phosphorus releases from the sediments). It is important to continually educate residents about how activities within the watershed can affect phosphorus loading and lake quality.

- **Figure 2 and Table 3:** The graphs in Figure 2 (Appendix A) show historical and current year data for lake/pond transparency. Table 3 lists the maximum, minimum and mean transparency data for each sampling season that the lake/pond has been monitored through the program.

Volunteer monitors use the Secchi-disk, a 20 cm disk with alternating black and white quadrants, to measure water clarity (how far a person can see into the water). Transparency, a measure of water clarity, can be affected by the amount of algae and sediment from erosion, as well as the natural colors of the water. The mean (average) summer transparency for New Hampshire's lakes and ponds is 3.7 meters.

Two different weather related patterns occurred this past spring and summer that influenced lake quality during the summer season.

In late May and early June of 2002, numerous rainstorms occurred. Stormwater runoff associated with these rainstorms may have increased phosphorus loading, and the amount of soil particles washed into waterbodies throughout the state. Some lakes and ponds experienced lower than typical transparency readings during late May and early June.

However, similar to the 2001 sampling season, the lower than average amount of rainfall and the warmer temperatures during the latter-half of the summer resulted in a few lakes/ponds reporting their best-ever Secchi-disk readings in July and August (a time when we often observe reduced clarity due to increased algal growth)!

The current year data (the top graph) show that the in-lake transparency **decreased slightly** from June to August. The transparency in June was **slightly greater than** the state mean, and in August was **slightly less than** the state mean. It is important to note that as the chlorophyll-a concentration *increased* from June to August, the transparency *decreased*. We generally expect this inverse relationship in lakes. As the amount of algal cells increases in the water column, the transparency typically decreases.

The historical data (the bottom graph) show that the 2002 mean transparency is **approximately equal to** the state mean.

Again, after 10 consecutive years of sample collection, we will be able to conduct a statistical analysis of the historic data to objectively determine if there has been a significant change in the annual mean transparency since monitoring began.

Typically, high intensity rainfall causes erosion of sediments into lakes/ponds and streams, thus decreasing clarity. Efforts should continually be made to stabilize stream banks, lake/pond shorelines, disturbed soils within the watershed, and especially dirt roads located immediately adjacent to the edge of tributaries and the lake/pond. Guides to Best Management Practices designed to reduce, and possibly even eliminate, nonpoint source pollutants, such as sediment loading, are available from NHDES upon request.

- **Figure 3 and Table 8:** The graphs in Figure 3 (Appendix A) show the amounts of phosphorus in the epilimnion (the upper layer) and the hypolimnion (the lower layer); the inset graphs show current year data. Table 8 (Appendix B) lists the annual maximum, minimum, and median concentration for each deep spot layer and each tributary since the lake/pond has joined the program.

Phosphorus is the limiting nutrient for plant and algae growth in New Hampshire's freshwater lakes and ponds. Too much phosphorus in a lake/pond can lead to increases in plant and algal growth over time. The median summer total phosphorus concentration in the epilimnion (upper layer) of New Hampshire's lakes and ponds is 11 ug/L. The median summer phosphorus concentration in the hypolimnion (lower layer) is 14 ug/L.

The current year data for the epilimnion (the top inset graph) show that the total phosphorus concentration **increased slightly** from June to August. The total phosphorus concentration in June and August was **slightly greater than** the state median.

The current year data for the hypolimnion (the bottom inset graph) show that the total phosphorus concentration **decreased slightly** from June to August. The total phosphorus concentration on both sampling events was **less than** the state median.

As discussed previously, after 10 consecutive years of sample collection, we will be able to conduct a statistical analysis of the historic data to objectively determine if there has been a significant change in the annual mean phosphorus concentration since monitoring began.

One of the most important approaches to reducing phosphorus loading to a waterbody is to continually educate watershed residents about its sources and how excessive amounts can adversely impact

the ecology and value of lakes and ponds. Phosphorus sources within a lake or pond's watershed typically include septic systems, animal waste, lawn fertilizer, road and construction erosion, and natural wetlands. If you would like to educate watershed residents about how they can help to reduce phosphorus loading into the lake/pond, please contact the VLAP Coordinator.

#### **TABLE INTERPRETATION**

➤ **Table 2: Phytoplankton**

Table 2 lists the current and historic phytoplankton species observed in the lake/pond. The dominant phytoplankton species observed this year were ***Hyalotheca* and *Mougeotia***, which are both species of **filamentous green algae**.

Phytoplankton populations undergo a natural succession during the growing season (Please refer to page 12 of the "Biological Monitoring Parameters" section of this report for a more detailed explanation regarding seasonal plankton succession). Diatoms and golden-brown algae are typical in New Hampshire's less productive lakes and ponds. An overabundance of cyanobacteria (previously referred to as blue-green algae) indicates that there may be an excessive total phosphorus concentration in the lake/pond, or that the ecology is out of balance. Some species of cyanobacteria can be toxic to livestock, pets, wildlife, and humans. (Please refer to pages 12 - 14 of the "Biological Monitoring Parameters" section of this report for a more detailed explanation regarding cyanobacteria).

➤ **Table 4: pH**

Table 4 (Appendix B) presents the in-lake and tributary current year and historical pH data.

pH is measured on a logarithmic scale of 0 (acidic) to 14 (basic). pH is important to the survival and reproduction of fish and other aquatic life. A pH below 5.5 severely limits the growth and reproduction of fish. A pH between 6.5 and 7.0 is ideal for fish. The mean pH value for the epilimnion (upper layer) in New Hampshire's lakes and ponds is 6.5, which indicates that the surface waters in state are slightly acidic. For a more detailed explanation regarding pH, please refer to page 16 of the "Chemical Monitoring Parameters" section of this report.

The mean pH at the deep spot this season ranged from **4.83** in the hypolimnion to **4.76** in the epilimnion, which means that the pond is **acidic**.

Due to the presence of granite bedrock in the state and the deposition of acid rain, there is not much that can be done to effectively increase lake/pond pH.

➤ **Table 5: Acid Neutralizing Capacity**

Table 5 in Appendix B presents the current year and historic epilimnetic ANC for each year the lake/pond has been monitored through VLAP.

Buffering capacity or ANC describes the ability of a solution to resist changes in pH by neutralizing the acidic input to the lake. For a more detailed explanation, please refer to page 16 of the “Chemical Monitoring Parameters” section of this report.

The Acid Neutralizing Capacity (ANC) of the epilimnion (the upper layer) is **very low** (-0.90 mg/L as CaCO<sub>3</sub>) and is **well below** the state mean of 6.7 mg/L (Table 5). Specifically, this means that the lake/pond is **“acidified”**.

➤ **Table 6: Conductivity**

Table 6 in Appendix B presents the current and historic conductivity values for tributaries and in-lake data. Conductivity is the numerical expression of the ability of water to carry an electric current. For a more detailed explanation, please refer to page 16 of the “Chemical Monitoring Parameters” section of this report.

The conductivity in the lake/pond is relatively **low**. Typically conductivity levels greater than 100 uMhos/cm indicate the influence of human activities on surface water quality. These activities include septic system leachate, agricultural runoff, iron deposits, and road runoff (which contains road salt during the spring snow melt). The low conductivity level in the lake/pond is an indication of the low amount of pollutants in the watershed. We hope this trend continues!

➤ **Table 8: Total Phosphorus**

Table 8 in Appendix B presents the current year and historic total phosphorus data for in-lake and tributary stations. Phosphorus is the nutrient that limits the algae’s ability to grow and reproduce. Please refer to page 17 of the “Chemical Monitoring Parameters” section of this report for a more detailed explanation.

➤ **Table 9 and Table 10: Dissolved Oxygen and Temperature Data**

Table 9 in Appendix B shows the dissolved oxygen/temperature profile(s) for the 2002 sampling season. Table 10 shows the historical

and current year dissolved oxygen concentration in the hypolimnion (lower layer). The presence of dissolved oxygen is vital to fish and amphibians in the water column and also to bottom-dwelling organisms. Please refer to the “Chemical Monitoring Parameters” section of this report for a more detailed explanation.

Dissolved oxygen was again **high** at all depths sampled at the deep spot of the lake/pond. Typically, shallow lakes and ponds that are not deep enough to stratify into more than one or two layers will have relatively high amounts of oxygen at all depths. This is due to continual lake mixing and diffusion of oxygen into the bottom waters induced by wind and wave action.

➤ **Table 11: Turbidity**

Table 11 in Appendix B lists the current year and historic data for in-lake and tributary turbidity. Turbidity in the water is caused by suspended matter, such as clay, silt, and algae. Water clarity is strongly influenced by turbidity. Please refer to page 19 of the “Other Monitoring Parameters” section of this report for a more detailed explanation.

## **DATA QUALITY ASSURANCE AND CONTROL**

### **Sample Receipt Checklist:**

Each time your monitoring group dropped off samples at the laboratory this summer, the laboratory staff completed a sample receipt checklist to assess and document if the volunteer monitors followed proper sampling techniques when collecting the samples. The purpose of the sample receipt checklist is to minimize, and hopefully eliminate, future re-occurrences of improper sampling techniques.

Overall, the sample receipt checklist showed that your monitoring group did a **very good** job when collecting samples this season! Specifically, the members of your monitoring group followed the majority of the proper field sampling procedures when collecting and submitting samples to the laboratory. However, the laboratory did identify one aspect of sample collection that the volunteer monitors could improve upon.

- **Secchi-disk Readings:** When measuring the transparency at the deep spot, please remember to take at least two secchi disk readings and record these on the field data sheet. Since the depth to which the secchi disk can be seen in the water can vary depending on how windy or sunny it is, and also on the eyesight of the volunteer monitor, it is best to have at least two people take readings. In



addition, please make sure that the readings are taken on the shady, non-windy side of the boat.

### **NOTES**

- Monitor's Note (8/12/02): Pond very low.

### **USEFUL RESOURCES**

*Changes to the Comprehensive Shoreland Protection Act: 2001 Legislative Session*, NHDES Fact Sheet, (603) 271-3505, or [www.des.state.nh.us/factsheets/sp/sp-8.htm](http://www.des.state.nh.us/factsheets/sp/sp-8.htm)

*Cyanobacteria in New Hampshire Waters Potential Dangers of Blue-Green Algae Blooms*, NHDES Fact Sheet, (603) 271-3505, or [www.des.state.nh.us/factsheets/wmb/wmb-10.htm](http://www.des.state.nh.us/factsheets/wmb/wmb-10.htm)

*The Lake Pocket Book*. Prepared by The Terrene Institute, 2000. (internet: [www.terrene.org](http://www.terrene.org), phone 800-726-4853)

*Managing Lakes and Reservoirs, Third Edition, 2001*. Prepared by the North American Lake Management Society (NALMS) and the Terrene Institute in cooperation with the U.S. Environmental Protection Agency. Copies are available from NALMS (internet: [www.nalms.org](http://www.nalms.org), phone 608-233-2836), and the Terrene Institute (internet: [www.terrene.org](http://www.terrene.org), phone 800-726-4853)

*Proper Lawn Care in the Protected Shoreland: The Comprehensive Shoreland Protection Act*, WD-SP-2, NHDES Fact Sheet, (603) 271-3503 or [www.des.state.nh.us/factsheets/sp/sp-2.htm](http://www.des.state.nh.us/factsheets/sp/sp-2.htm)

*Sand Dumping - Beach Construction*, WD-BB-15, NHDES Fact Sheet, (603) 271-3503 or [www.des.state.nh.us/factsheets/bb/bb-15.htm](http://www.des.state.nh.us/factsheets/bb/bb-15.htm)

*Swimmers Itch*, WD-BB-2, NHDES Fact Sheet, (603) 271-3503 or [www.des.state.nh.us/factsheets/bb/bb-2.htm](http://www.des.state.nh.us/factsheets/bb/bb-2.htm)

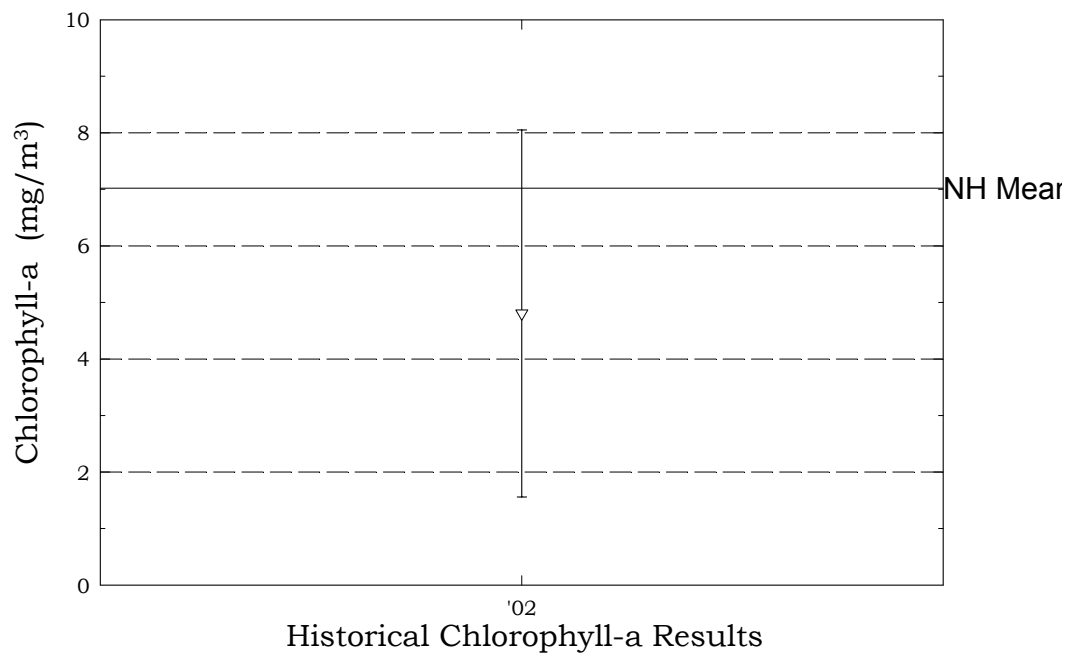
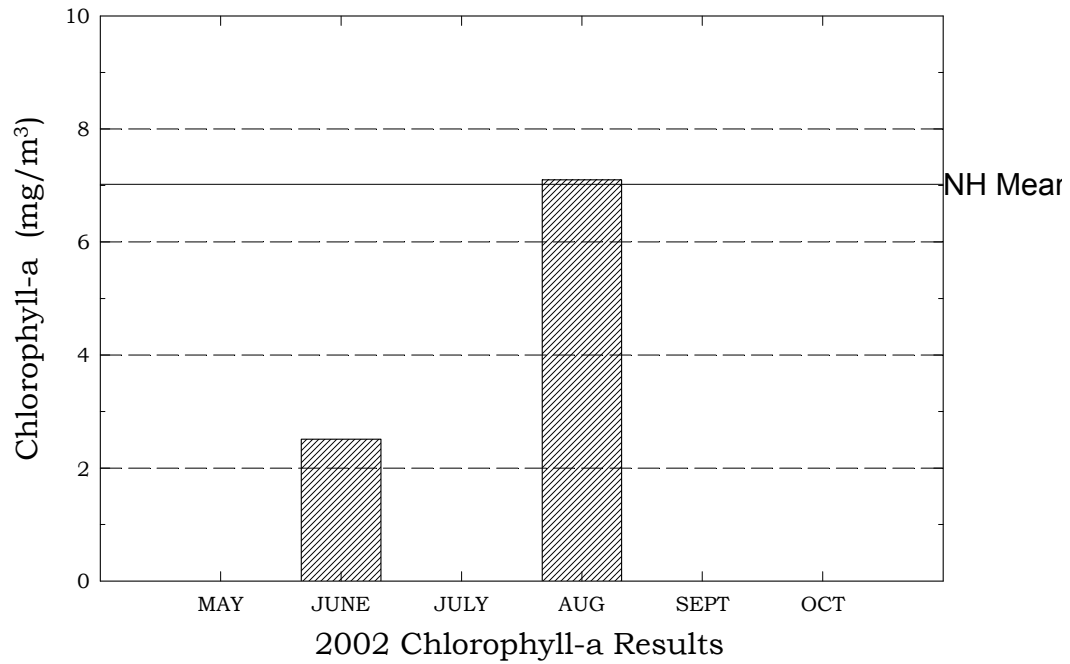
*Use of Lakes or Streams for Domestic Water Supply*, WD-WSEB-1-11, NHDES Fact Sheet, (603) 271-3503 or [www.des.state.nh.us/factsheets/ws/ws-1-11.htm](http://www.des.state.nh.us/factsheets/ws/ws-1-11.htm)

*Weed Watchers: An Association to Halt the Spread of Exotic Aquatic Plants*, WD-BB-4, NHDES Fact Sheet, (603) 271-3503 or [www.des.state.nh.us/factsheets/bb/bb-4.htm](http://www.des.state.nh.us/factsheets/bb/bb-4.htm)

# Appendix A: Graphs

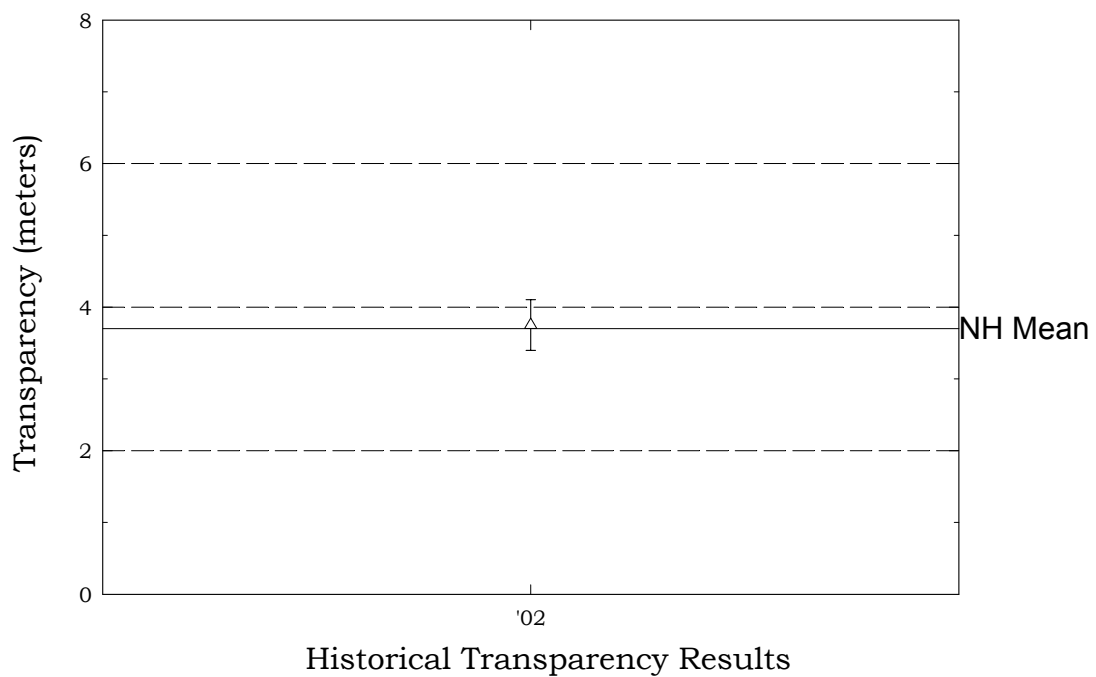
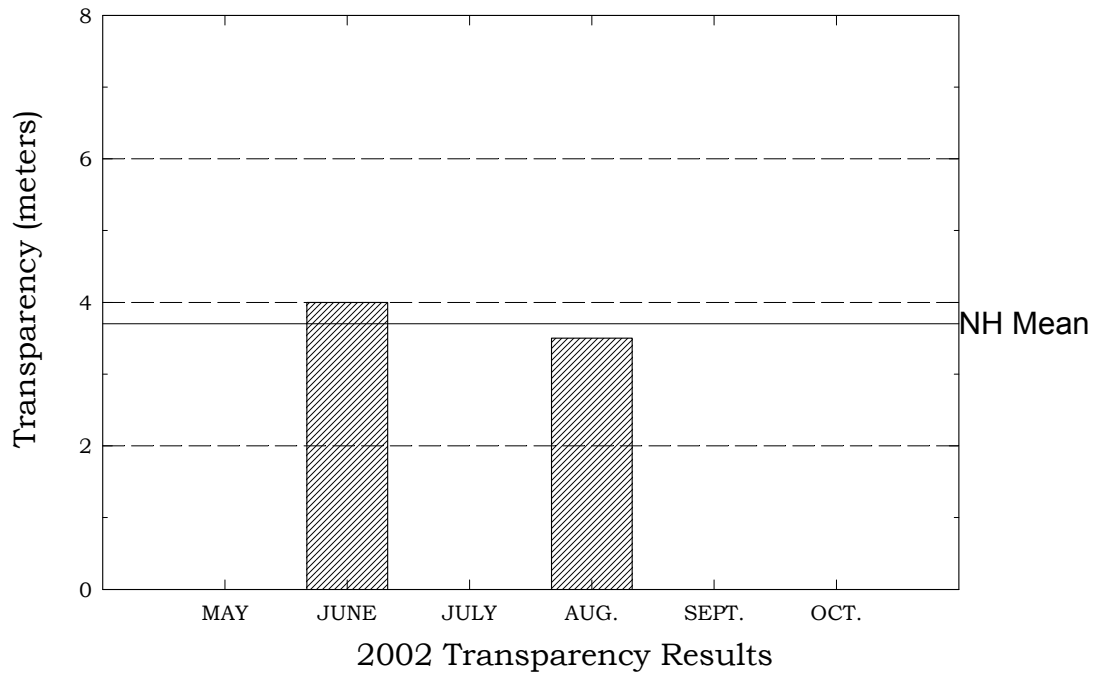
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**Figure 1.** Monthly and Historical Chlorophyll-a Results



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**Figure 2.** Monthly and Historical Transparency Results



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**Figure 3.** Monthly and Historical Total Phosphorus Data.

